

APPENDIX B

Recommendations for Restoration Projects

The following recommendations were developed in conjunction with U.S. Fish and Wildlife Service for enhancement and restoration activities, which may be conducted through grants or as mitigation to offset impacts. Ideally, plans for implantation of all vernal pool restoration/ enhancement plans should include the criteria listed below. However, for grant projects where limited funds are available, it may be appropriate to reduce the requirement to fulfill some of the monitoring or success criteria in order to maximize the monies spent for on-the-ground restoration/enhancement actions. Improved management and/or construction practices may be substituted for these recommendations on a project-by-project basis upon written approval of the agency conferring take of vernal pool species.

- a) Consultation with the agency conferring take for vernal pool species when listed species are present.
- b) Restoration and enhancement of associated uplands and watersheds, if needed, to promote ecosystem functioning.
- c) Plans for grading, planting, and irrigation that include the following:
 - i) All final specifications and topographic-based grading, planting and irrigation plans (with 0.5-foot contours and typical cross-sections) for the restoration/enhancement sites.
 - ii) Identification that a qualified biologist with a minimum 3 years of vernal pool restoration experience and approved by the agency conferring take for vernal pool species, will direct the grading for the restored and enhanced vernal pools.
 - iii) All grading for restoration or enhancement will be conducted outside the rainy season (i.e., from April 15 to October 15) or consistent with the following criteria:
 - (1) Grading will occur only when the soil is dry to the touch both at the surface and one inch below. A visual check for color differences (i.e., darker soil indicating moisture) in the soil between the surface and one inch below indicates the soil is dry.
 - (2) After a rain of greater than 0.2 inch, grading will occur only after the soil surface has dried sufficiently as described above, and no sooner than two days (48 hours) after the rain event ends.
 - (3) To prevent erosion and siltation from storm water runoff due to unexpected rains, Best Management Practices (i.e., silt fences) will be implemented as needed during grading.

- (4) If rain occurs during grading, work will stop and resume only after soils are dry, as described above.
- iv) Planting palettes (plant species, size and number/acre) and seed mix (plant species and pounds/acre) for the restoration/enhancement areas. The proposed plant palettes shall include only native species specifically associated with the series of vernal pools associated with the restoration location. Only locally native species (no cultivars) obtained close to the project area shall be used. The source and proof of local nativeness of all plant material and seed shall be provided.
 - v) Topsoil and native plant materials salvaged from impacted areas, if any, (including live herbaceous, shrub and tree species) transplanted to, and/or used as a seed/cutting source for, the restoration and enhancement areas to the maximum extent practicable.
 - vi) Collection of topsoil containing seeds, spores, bulbs, eggs, and other propagules from adjacent vernal pool and upland habitats, translocation of propagules of individual species from offsite habitats, and use of commercially available native plant species can be utilized for enhancement or restoration if it comes from a similar vernal pool series. The location of all sources of transplantation material for each must be documented.
 - vii) Topsoil (inoculum) shall be collected when dry to avoid damaging or destroying fairy shrimp cysts. Hand tools (i.e., shovels and trowels) will be used to remove the first 2 inches of soil from the pools. Whenever possible, the trowel shall be used to pry up intact chunks of soil, rather than loosening the soil by raking and shoveling which can damage the cysts. The soil from each pool will be stored individually in labeled boxes that are adequately ventilated and kept out of direct sunlight in order to prevent the occurrence of fungus or excessive heating of the soil, and stored off-site at an appropriate facility for vernal pool inoculum. Inoculum from different source pools shall not be mixed for seeding any restored pools. Additional inoculum may be desirable to supplement the inoculum salvaged from the pools to be impacted on site. No more than 10 percent of the inoculum present in any non-impacted donor pool shall be removed to minimize any adverse effects to the donor pool. The collected soils shall be spread out and raked into the bottoms of the restored pools. Inoculum will be placed in a manner that preserves, to the maximum extent possible, the orientation of the fairy shrimp cysts within the surface layer of soil (e.g., collected inoculum will be shallowly distributed within the pond so that cysts have the potential to be brought into solution upon inundation).

- viii) Inoculum and plantings shall be introduced into the restored pools only until after the restored ponds have been demonstrated to retain water for the appropriate amount of time to support transplanted species [e.g., at least 30 days for San Diego fairy shrimp (Hathaway and Simovich 1996, Ripley et. al. 2004)].
 - ix) All plantings shall be installed in a way that mimics natural plant distribution, and not in rows.
 - x) Exotic weed control within the restoration/enhancement areas. All weeding within and immediately adjacent to the restored and existing vernal pools will be performed by hand. No herbicide will be used within the restored and preserved vernal pools, unless applied utilizing the glove method and supervised by a qualified biologist/restoration specialist. All workers conducting weed removal activities shall be educated to distinguish between native and non-native species so that local native species are not inadvertently killed by weed removal actions.
 - xi) Identification of measures that may be incorporated into the restoration and enhancement activities to prevent the introduction and spread of common fairy shrimp (*Branchinecta lindahli*) into enhancement/restoration areas. Possible measures may include, but are not required to include, protocol surveys of depressional features to determine which species of fairy shrimp occupy the depressional features in which inoculum is proposed to be collected. Then, inoculum from depressional features found to contain *B. lindahli* would not be utilized for vernal pool restoration.
- d) An initial monitoring and management plan with success criteria that include the following:
- i) A minimum five-year maintenance and monitoring program for restored/enhanced vernal pools and their contributing watersheds. The monitoring program shall include quantitative hydrological, vegetation transects, viable cyst, hatched fairy shrimp, and gravid female measurements, and complete floral and fauna inventories, and photographic documentation. The method used for all quantitative measures will be adequately described in the restoration plan. It is suggested that stratified-random sampling shall be used for all quantitative surveys at larger sites, and census surveys shall be used at smaller sites where it is not cost- and personnel- prohibitive. Vernal pools selected as reference or control pools for evaluating restoration success shall be identified and described in the restoration plan. To minimize impacts to the vernal pool's soil surface during monitoring, cobbles could be oriented within the vernal pools to serve as stepping stones.

- ii) Restoration/enhancement success for vernal pools shall be partially determined by measuring the ponding of water. Measurements shall be taken in the enhanced/restored ponds to determine the depth, duration and quality (i.e., pH, temperature, total dissolved solids, and salinity) of ponding. The enhanced and restored pools must pond for a period of time within a range established by reference vernal pools during an average rainfall year and at an appropriate depth and quality to support fairy shrimp.
- iii) Enhancement/restoration success for fairy shrimp shall be determined by measuring the ponding of water; and density of viable cysts, hatched fairy shrimp, and gravid females, within the enhanced/restored ponds. Dry samples shall be taken in the enhanced/restored pools to determine the density of viable cysts in the soils. Wet samples shall also be taken in the enhanced and restored pools to determine the density of hatched fairy shrimp and gravid females. The enhanced and restored pond's average viable cyst, hatched fairy shrimp, and gravid female density must not differ significantly ($p < 0.05$) from reference pools for at least three wet seasons before a determination of success can be made.
- iv) Monitoring and success criteria for vegetation shall include: a qualitative and quantitative vegetation monitoring plan with a map of proposed sampling locations; photo points for qualitative monitoring and stratified-random sampling for all quantitative monitoring; separate percent cover, composition, and diversity criteria for plants in vernal pools and appropriate adjacent uplands at the end of 5 years; a total of 40-65 percent absolute cover of native upland vegetation; evidence of natural recruitment of multiple species; 0 percent coverage for those species listed for Cal-IPC inventory of invasive plants; no more than 10 percent coverage for other exotic/weed species in the watersheds/uplands surrounding the restored/enhanced pools; and, no more than one percent cover of exotic/weed species in restored/enhanced vernal pools. Container plant survival shall be 80 percent of the initial plantings for the first 5 years. At the first and second anniversaries of plant installation, all dead plants shall be replaced unless their function has been replaced by natural recruitment.
- v) Completion of creation/restoration/enhancement obligations should not occur within two years of significant remediation.
- vi) Contingency measures in the event of restoration/enhancement failure. If a performance criterion is not met for any of the restored or enhanced vernal pools or upland habitat in any year, or if the final success criteria are not met, the project proponent shall prepare an analysis of the cause(s) of failure and proposed remediation.

- e) An implementation schedule that indicates when all vernal pool and adjacent upland habitat restoration/enhancement grading, planting and irrigation (uplands only), shall begin and end, recognizing that all schedules are subject to yearly rainfall variations. Necessary site preparation and planting shall be completed during the concurrent or next planting season (i.e., late fall to early spring) after it has been demonstrated that the restored or enhanced vernal pools appropriately ponds water.
 - f) Requirement that annual reports be submitted to the agency conferring take for vernal pool species, as well as any other agencies conferring development permits, to assess both the attainment of yearly success criteria and progress toward the final success criteria.
- 2) In addition to all the criteria listed under 2 above, mitigation to offset impacts to vernal pools should include the following:
- a) To minimize the temporal loss of vernal pool habitat, restoration and enhancement activities should be initiated on the ground prior to, or concurrent with, initiation of impacts.